

Harmful Algae Bloom Operational Strategy

1. Executive Summary

Alter the timing and volume of Lake Okeechobee releases to the Water Conservation Areas (WCAs), east, and/or west to allow for greater flexibility with water management decisions when harmful algae blooms (HABs) are present in Lake Okeechobee, the St Lucie or Caloosahatchee estuaries or the system of canals that connects them.

2. What

Planned deviation to the Water Control Plan for Lake Okeechobee and Everglades Agricultural Area (also known as Lake Okeechobee Regulation Schedule [LORS] 2008). Main changes to the LORS 2008 to include operations for HABs can be summarized as follows:

Allow the flexibility to make larger releases east and west than LORS Part D calls for and make releases south when LORS Part C does not recommend releases within the Beneficial Use Sub-Band, Base Flow Sub-Band, Low Sub-Band and the Intermediate Sub-Band.

- Releases east and west would be limited to 2,000 cfs measured at S-79 and up to 730 cfs measured at S-80, and would only be applicable when releases recommended in LORS Part D recommend 450 cfs measured at S-79 and 200 cfs measured at S-80 or when Part D does not specifically recommend releases (Beneficial Use Sub-band).
- Allow the flexibility to make up to maximum practicable releases south to the WCAs when LORS Part C does not recommend release.
- These larger releases will allow greater flexibility to reduce releases during times when HAB are present in the Lake or Estuary systems.
- The cumulative volume of water released under the planned deviation will be tracked against the volume held back that would have been released under LORS 2008. The objective will be to reach a net zero balance such that the total volume released across the entire year is unchanged from the releases that would have taken place under the existing schedule.

These operations would only be utilized if conditions were met for HAB operations (see below section 6-a. The decision making-making process will remain unchanged from LORS 2008 and is included below for consistency.

The decision-making process for Lake Okeechobee water management operations considers all Congressionally-authorized project purposes. The decision-making process to determine quantity, timing, and duration of the potential release from Lake Okeechobee includes consideration of, but not limited to: C&SF Project conditions, historical lake levels, estuary conditions/needs, lake ecology conditions/needs, Water Conservation Area water levels, Stormwater Treatment Area available capacity, current climate conditions, climate forecasts, hydrologic outlooks, projected lake level rise/recession, and water supply conditions/needs.

3. Why

The algae crisis has caused substantial and widespread impacts to Florida communities over the last several years resulting in state declared emergencies in multiple counties (Glades, Hendry, Lee, Martin, Okeechobee, Palm Beach, and St. Lucie counties)¹. The State of Florida has deployed two emergency task forces to address algal blooms and invested significant resources to develop and implement solutions to the algae crisis. The Corps operates in order to minimize the health effects associated with HABs, specifically toxins sometimes produced by the algae. This deviation will enhance the ability of the Corps to respond to HABs within its authority.

4. When

The planned deviation would be implemented as soon as possible. The planned deviation will be in effect for a minimum duration of one year. The Corps Water Management Section's assessment of hydrometeorological conditions and stakeholder or agency input may suspend or discontinue the planned deviation due to impacts greater than expected/discussed *within the associated EA that supports the deviation*. Termination of this deviation may be implemented at any time. Reevaluation of and possible extension of the planned deviation will occur after year one of implementation. The duration of the planned deviation may extend until LORS 2008 is replaced by a new water control plan (to be called the Lake Okeechobee System Operation Manual (LOSOM)) anticipated in 2022.

5. Definitions

Harmful Algal Bloom (HAB) - freshwater blue/green algae bloom causing adverse environmental, economic, or health effects

6. How

6-a. Any one of these conditions could warrant the use HAB operations to be utilized:

1. If a HAB is currently in Lake Okeechobee, C-43, C-44, the Caloosahatchee Estuary, or the St. Lucie Estuary.
2. If the state of Florida declares a state of emergency due to HABs on Lake Okeechobee, C-43, C-44, the Caloosahatchee Estuary, or the St. Lucie Estuary.
3. If a HAB is anticipated to occur on Lake Okeechobee, C-43, C-44, the Caloosahatchee Estuary, or the St. Lucie Estuary.
4. If a HAB has occurred and caused harm, or have impacted public safety during the last 18 months within Lake Okeechobee, C-43, C-44, the Caloosahatchee Estuary, or the St. Lucie Estuary.

6-b. Operations under these circumstances could include:

- If any of the conditions above are met, the following represents the operational strategy:
 - o Manage water to reduce the risk of transporting a bloom from Lake Okeechobee to the estuaries
 - o Manage water to reduce risk of exacerbating a bloom in the estuaries
 - o Manage water in anticipation of HAB conditions by making long term low volume releases before and after a HAB event and not during
 - o Manage lake levels to improve the ecology of Lake Okeechobee, especially when improved lake health could reduce the risk of a HAB occurring in future years

When initializing HAB operations, effort should be made to engage with federal and state agencies/task forces to develop a unique plan on timing and quantity of advance releases/make up releases to be made under these operations, as the expertise in water quality lies outside the Corps. This plan should be re-evaluated for each instance of these operations.

The duration of HAB operations is not prescribed, but should be based on the conditions that led to the implementation. The risk to human health and safety due to HABs will be evaluated at the time based on the best available science and in close coordination with agencies which have the technical knowledge to help develop a plan for the timing and quantity of releases (within the bounds of this deviation). It is acknowledged that the science in this field is rapidly developing therefore specific durations and timings of these operations cannot be defined for the operational strategy at this time.

Releases as part of HAB operations could be done between the Intermediate sub-band and the Water Shortage Management Band (WSM) (see Figure 1).

6-c. Conditions under which HAB operations would not be implemented

If conditions such as current or forecasted tropical activity, above normal precipitation for the wet season, or El Niño in the dry season exist, releases may not be held back (even with a HAB) due to the risk of inadequate flood control and/or dam safety. The decision to postpone releases because of HAB decisions will be unique each time. The Corps must weigh the dam safety risk of holding back releases and against risks associated with HABs. Dam safety risk can be informed by tropical activity/forecasts, precipitation forecasts, lake level, projected lake level and many other factors. HAB operations do not guarantee that releases will not be made during bloom conditions in any way, but give the Corps the flexibility to do so.

Ecological conditions within Lake Okeechobee, the estuaries, or the WCAs would be evaluated and if recommendations by other agencies were made against releases for risk of causing harm then releases may not be made. Conditions within Lake Okeechobee itself which may case releases to not be made include water levels receding at rates exceeding that which is outlined in the LORS 2008 Biological Opinion (<0.5 ft/month) in addition to other conditions not defined here. Ecological conditions within the Water Conservation Areas (WCAs) would also be evaluated, as per normal operations under LORS 2008. If water levels or rates of rise within

the WCAs caused by these HAB operations were forecasted then releases south may not be made.

Water supply conditions would also be evaluated and if significant impacts to water supply (such as risk of falling into the Water Shortage Management Band [WSM]) were high. Releases would be cut back if lake levels were within 0.25 feet of the WSM to reduce the risk of falling into this band. Advanced releases or make-up releases would not be utilized if conditions such as drought or La Niña are forecasted, due to the risk to water supply.

6-d. Releases South from Lake Okeechobee

Releases south would be evaluated first, consistent with LORS 2008 intent. If LORS Part C (see Figure 2) does not recommend release south, and HAB conditions are in effect (as defined in section 6-a were in effect), then releases south up to maximum practicable could be made. Releases made and held back south would be banked the same as releases east/west as outlined in section 6-c. Releases made south would be done for HAB operations only when in the Low, Baseflow, and Beneficial Use Sub-bands and only if all WCAs were less than 0.25 feet above the max of the upper schedule (same conditions as LORS Part C guidance for Intermediate and High sub-bands). If releases south would cause any of the WCAs to rise more rapidly than is ecologically preferable, then release may not be sent south from the lake. Hydrologic, ecological, and water supply conditions within the WCAs would be taken into account before sending water south, just as releases south from Lake Okeechobee is typically managed. No impacts to the WCAs are anticipated for HAB operations.

6-e. Releases to Tide (East and West to Estuaries)

Releases could be made in advance of HAB events, which would be limited to the maximum of either the LORS Part D guidance (see Figure 3) or 2,000 cfs measured at S-79 and up to 730 cfs measured at S-80. The red boxes in the figures show the applicable boxes which could be subject to increased releases due to HAB operations. Not shown in the figure of Part D is the Beneficial Use Sub-band, which would also be subject to increased releases due to HAB operations. They would be “banked” as negative volumes to be tracked for a duration of 12 months from the beginning of the action (see Water Bank section 6-c below).

Releases could be postponed due to HABs (postponed meaning doing less than the up-to limits within Part D of LORS until after a HAB event) would be “banked” as positive volumes to be tracked. These will be tracked for a duration of 12 months from the beginning of the action to be released south, east, or west and may occur when Parts C and D do not allow for releases or prescribe a lower volume release. Make-up releases east/west would be limited to 2,000 cfs measured at S-79 and up to 730 cfs measured at S-80. The decision to postpone releases because of HAB decisions will be unique each time. The Corps must weigh the dam safety risk of holding back releases and against risks associated with HABs. Dam safety risk can be informed by tropical activity/forecasts, precipitation forecasts, lake level, projected lake level and many other factors. HAB operations do not guarantee that releases will not be made during bloom conditions in any way, but give the Corps the flexibility to do so. The implementation of

advanced releases before the decision to hold back releases for a HAB would help to ensure that dam safety risk was not increased as part of these operations for any length of time.

Releases could be made-up after the risk to public health and safety due to HABs is within tolerable levels releases by using the net volume of water within the “bank”. This ensures that releases under this condition would not have a net impact water supply, dam safety and all project purposes of Lake Okeechobee. See Water Bank section 6-c and Table 1 below. Releases would not *have* to be held off during a HAB, and could be made-up during the event if necessary.

Releases within the Beneficial Use Sub-band would be cut back if lake levels fell within 0.25 feet of the WSM Band in order to reduce the risk of falling into this band (indicated by the red dashed line in Figure 1). When lake stages are below the Lake Okeechobee Conceptual Ecological Model (below 12 feet) release would only be made if the lake was rising rapidly (greater than 0.15 feet per week on average). Attenuating the rate of rise on the lake can be ecologically beneficial to the lake ecology, including submerged aquatic vegetation and nesting birds and therefore have a positive impact. Releases would not be made if stages were declining and below 12 feet to try to avoid impacting Everglades Snail Kite, other nesting birds on Lake Okeechobee, and the overall lake ecology.

All releases under this HAB operations could be implemented in a pulse pattern or steady flows and should be based on the best available science. If a pulse is implemented, the duration of the pulse does not have a limit.

6-c. Water Bank for HAB operations

Releases made above or under LORS guidance will be tracked such that there is a net zero sum at the end of the 12 month tracking duration, as long as conditions warrant. Conditions which may impact the zero sum could be, but not limited to, a large rainfall or tropical event, drought, La Niña or El Niño, or environmental concerns. The tracking duration would be 12 months from the first implementation of these operations. Tracking and banking these release is intended to maintain the current dam safety/flood control as well as the water supply provided by the 2008 LORS. Releases held back (releases made under the LORS Part D guidance [see Figure 3]) will be banked as a “deposit” and have a positive volume. Releases made over LORS Part D guidance will be banked as a “withdrawal” or “loan” and have a negative volume. Values will be summed for a total bank amount which can be either positive or negative. At the end of the banking year, the balance should sum to zero. When the bank has a surplus (+) sum at any time then make-up releases should be made in the future to get the extra water out of the lake. When the bank has a deficit (-) at any time it means releases could be held back in the future to bring the sum to zero. Actual releases made will be based on the targeted weekly averages at the associated structure (either S-77 or S-79 depending on LORS Part D or HAB operations and S-80). The goal will always be to get to a zero balance by the end of the 12 month period. At the end of the 12 month accounting period, if in the unlikely chance that a balance is still present in the water bank it would be carried over to the following year in order to minimize impacts.

Releases made south to the WCAs under HAB operations when LORS Part C does not call for those releases would also be banked. Releases south are made for multiple reasons to

include water supply (for agricultural, municipal, and industrial uses as well as to prevent salt water intrusion along the east coast of Florida) as well as regulatory releases from Lake Okeechobee. When LORS Part C does not call for lake releases to be sent south, the water for water supply is still sent. To bank water sent south as part of HAB operations only water sent south to the STAs/WCAs from the lake for regulatory releases, water supply releases would continue as per normal operations. Releases made south when Part C does not call for them will be banked as negative volumes and releases held back when LORS Part C does call for releases will be banked as positive volumes.

The water bank will be one bank for all HAB operations where releases made or held back would be all put into the same bank. Make-up releases may be done to any of the lake outlets depending on where the need may occur. Needs may include, but not limited to, environmental releases to maintain salinities within the estuaries or to hydrate the WCAs during important nesting periods.

Table 1: HAB Operational Flexibility Accounting Example

(note the values in this table do not indicate maximums or minimums and are only used to illustrate a mathematic example of the banking to be done)

Week of	LORS Part D guidance (cfs)	Actual Releases made (cfs)	Delta Guidance/ LORS (cfs) (-) above LORS (+) below LORS	Duration (days)	Delta - Guidance/ LORS (ac-ft) (-) above LORS (+) below LORS
30-Jun	650	1,000	-350	7	-4,858
7-Jul	650	1,000	-350	7	-4,858
14-Jul	650	0	650	7	9,023
21-Jul	650	300	350	7	4,858
28-Jul	3,000	1,000	2,000	7	27,762
4-Aug	3,000	0	3,000	7	41,643
11-Aug	3,000	4,000	-1,000	7	-13,881
18-Aug	3,000	5,000	-2,000	7	-27,762
25-Aug	4,000	0	4,000	7	55,524
1-Sep	4,000	4,000	0	7	0
				Total (ac-ft)	87,450

(+) surplus means make up releases still need to be made because there is still more water to get out

(-) deficit means do not do make up releases as more water was released than intended under LORS

7. Potential effects

Since this deviation is expected to be in place for multiple years the impacts will be discussed in terms of several scenarios because exact conditions are unknown. If the operations are successful in their conception of this plan, net zero water bank at the end of the 12 month accounting period, there will be no expected effects to lake stage, and therefore no net effect project purposes. Since these operations will be effecting the timing of releases, temporarily there will be conditions which would lead to higher or lower releases and lake levels than those which would have been under LORS alone, but the overall volume of water released will not change and there will be no net effect.

Some scenarios where conditions may not be conducive to reaching net zero releases have been developed below in an effort to illustrate an envelope of effects. These scenarios are not meant to be all-inclusive or limiting in any way, but meant to identify any potential effects that this deviation could have. All effort will be made to anticipate factors to avoid the below scenarios.

Scenario 1 (potential impacts to water supply and no risk to dam safety): Advanced releases are made towards the beginning of the wet season in anticipation of a HAB, and then conditions turn unexpectedly drier than normal. There would be no lake releases to make-up, due to lake stages below the Baseflow sub-band – as LORS does not outline releases in this sub-band. In this case an assumption of a 30 day duration of advanced releases at 2,730 cfs is made (2,000 + 730 cfs – assuming all releases out of S-79 and S-80 came from Lake Okeechobee) which is 2,080 cfs over a Baseflow release of 650 cfs. Releasing 2,080 cfs for 30 days would affect lake stages by approximately 0.28 feet (123,740 ac-ft). This volume would have a nominal effect on water supply and starting stage for Everglade snail kite nesting the following dry season. This is considered the worst case scenario, but there is a low probability of this occurrence.

Scenario 2 (potential improvements to dam safety and minimal risk to water supply): Advanced releases are made towards the beginning of the wet season in anticipation of a HAB, and then a tropical storm or hurricane comes across the lake, bringing the lake up multiple feet into the High Lake Management Band. The most recent example of this was 2017 Hurricane Irma, which brought the lake up very quickly and took many months to release water back down to safe levels. In a scenario with a tropical event, releases may not be held back, to zero out the water bank account, due to dam safety risks. In this scenario, it is likely that most project purposes would benefit from releasing water out of Lake Okeechobee, most especially flood control/dam safety. In this case if the same flow and duration assumptions were made as in Scenario 1 (2,080 cfs for 30 days), the lake would crest 0.28 feet lower than without HAB operations, reducing the dam safety risk than if no HAB operations were implemented. There would be no risk project purposes (water supply, fish and wildlife enhancement, navigation, and recreation).

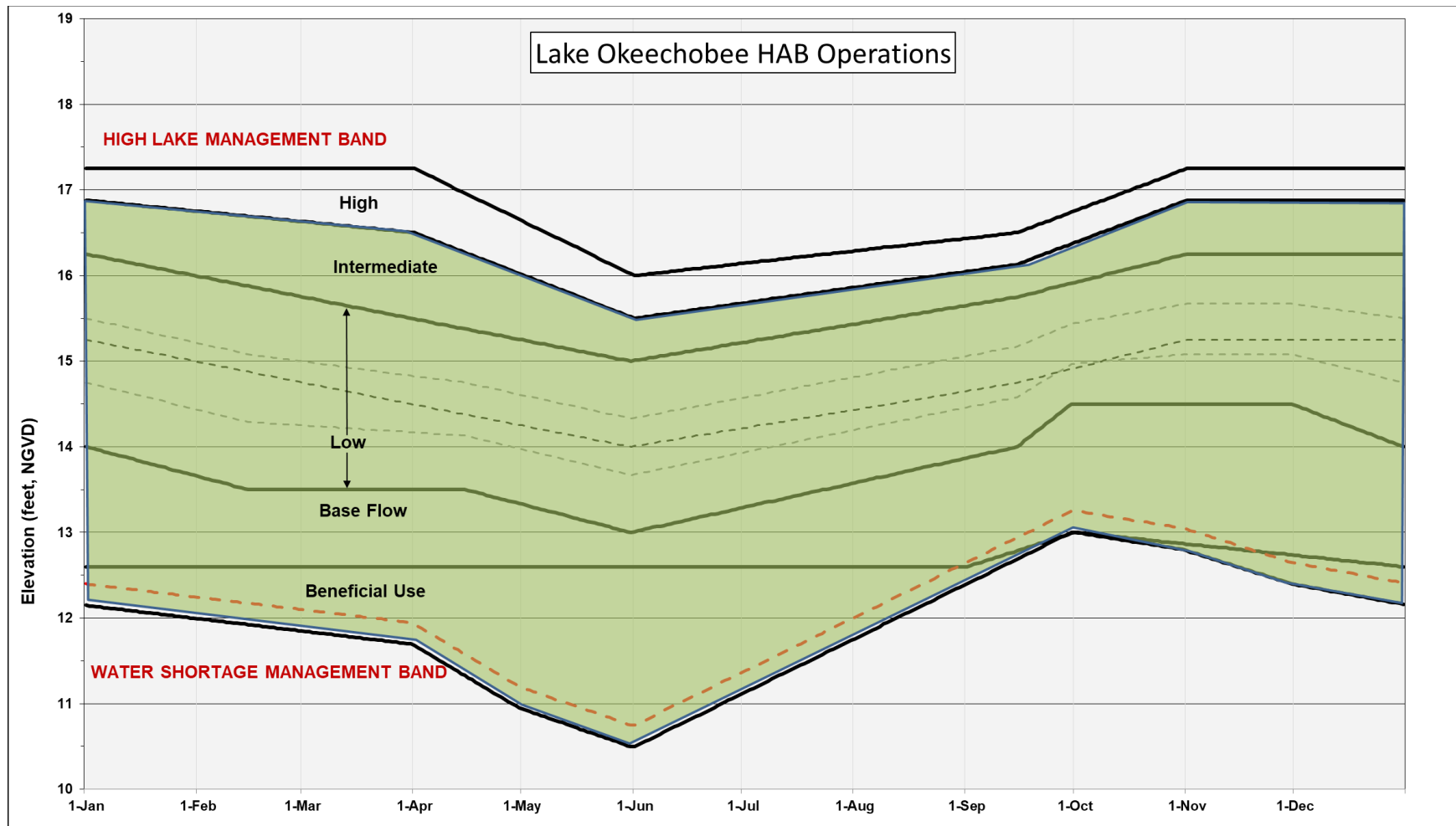


Figure 1: Range of lake stages where HAB operations could occur (shaded green area) with cutbacks in releases implemented 0.25 feet above Water Shortage Management Band (red dashed line).

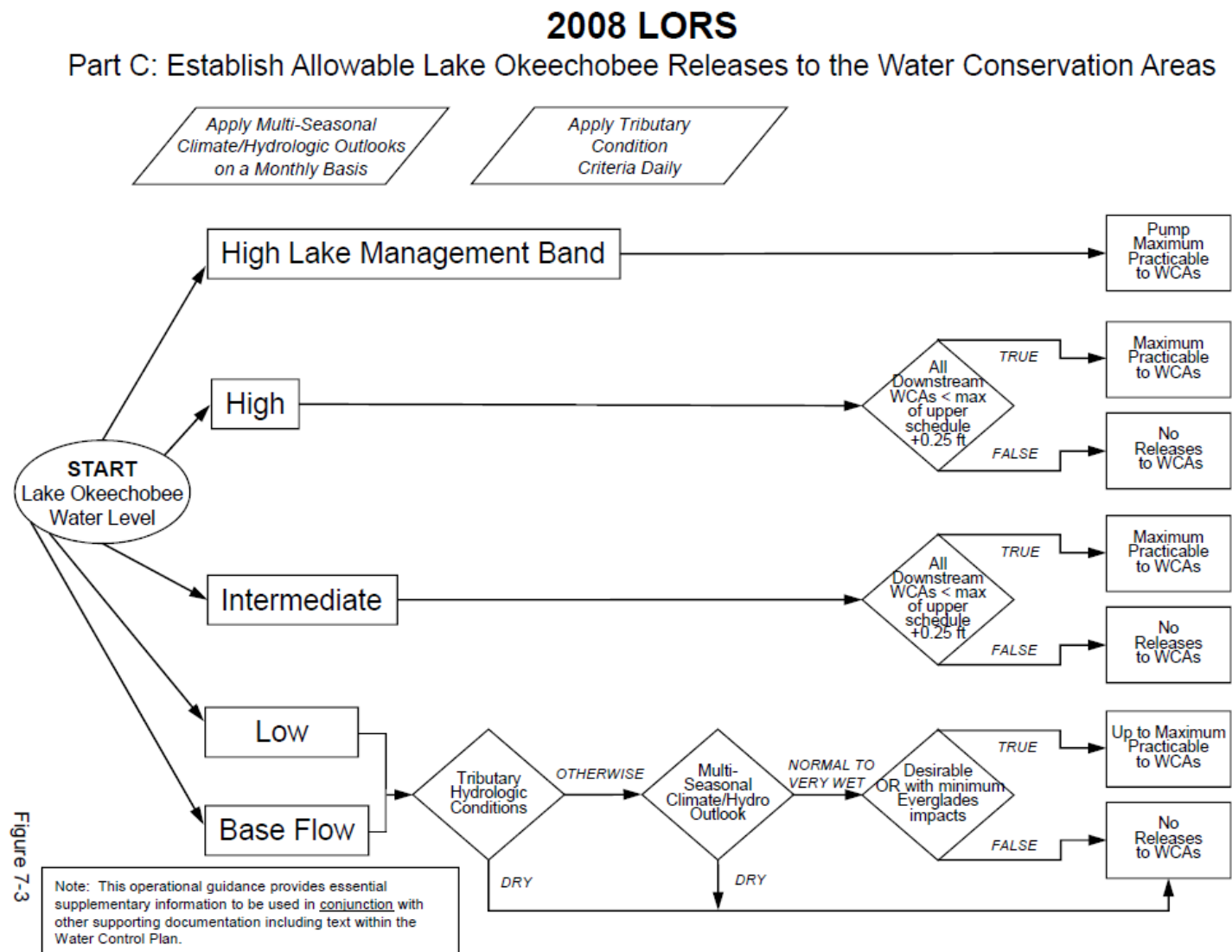


Figure 2: LORS Part C

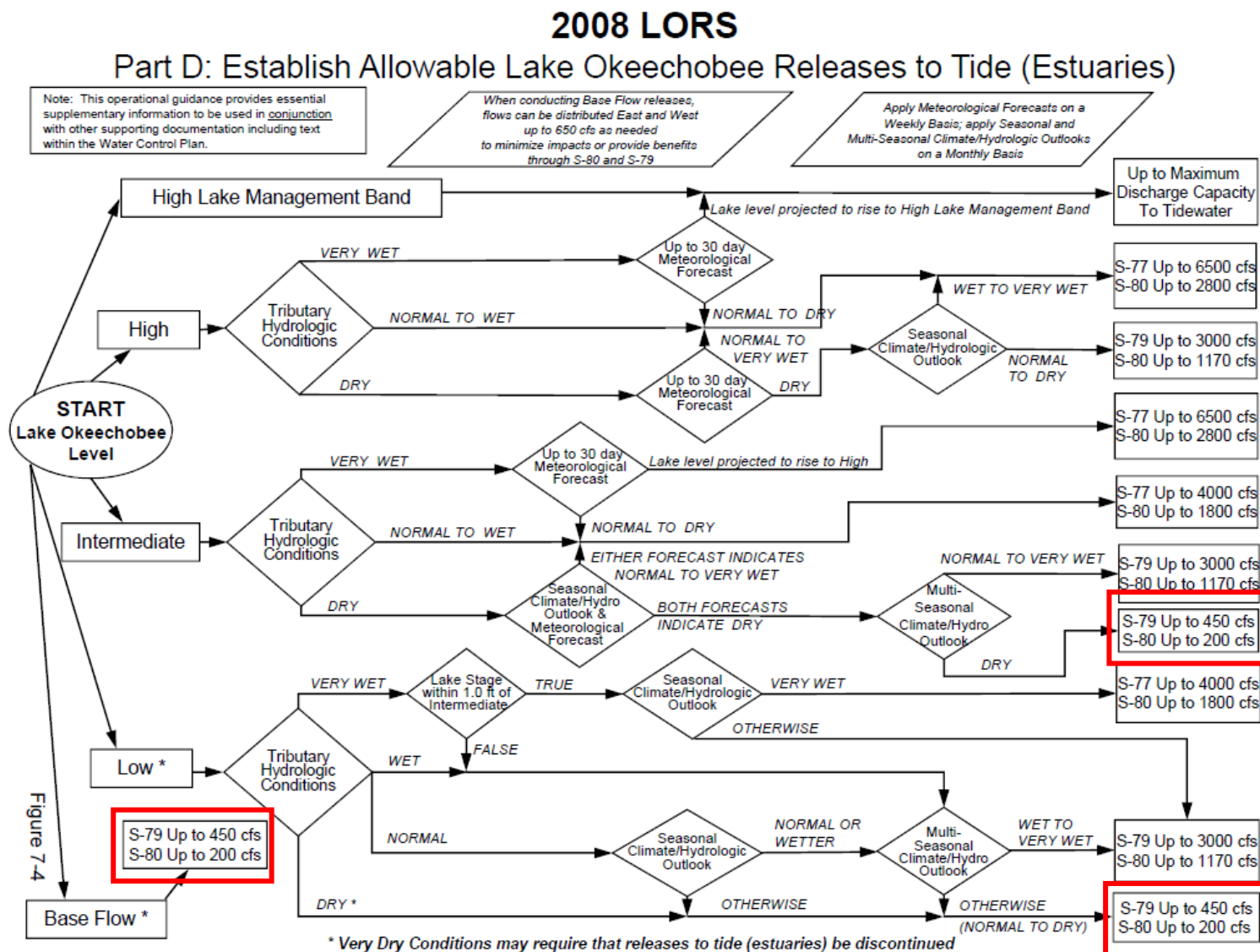


Figure 3: LORS Part D

8. References

1. <https://www.floridadisaster.org/news-media/news/20180709-gov.-scott-issues-emergency-order-to-combat-algal-blooms-in-south-florida/>